Disk Disruption from Stellar Encounters

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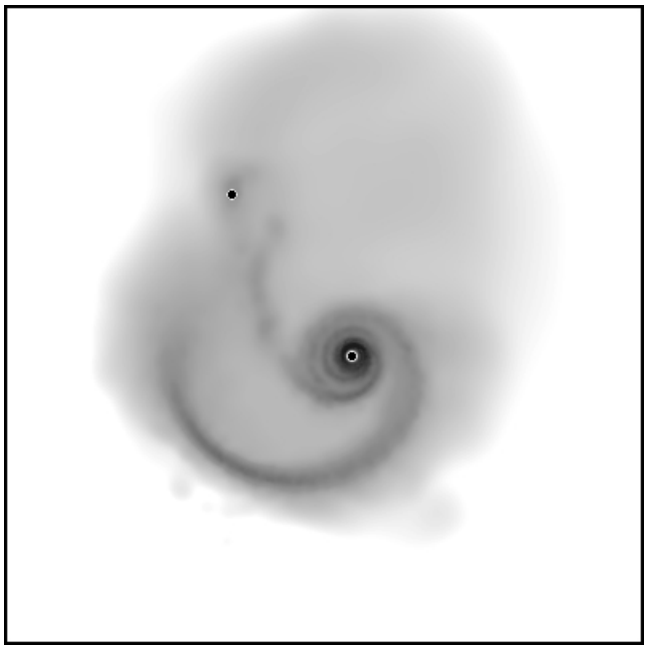
The dense clustered environment in which most stars are formed suggests that interactions with neighboring stars may have an impact on their formation and early evolution. It has been proposed that collisions between stars could contribute to their growth, and the presence of a protoplanetary disk around a star in an encounter can potentially assist the collision by increasing the interaction radius. It is likely that many stars in a cluster will undergo an encounter close enough to perturb any circumstellar disk; a solar mass star in a dense cluster will pass within 150 AU of another cluster member in a few thousand years.

Numerical simulations using the publicly available SPH code GADGET to study repeated encounters between a star-disk system and an impactor star are presented. These encounters result in several interesting effects on the protoplanetary disk, including spiral arm features, shocks, transfer of disk material to the impactor star, and in some cases almost total disruption of the initial disk. Certain cases created dynamically ejected, wide angle, periodic bipolar outflows.



A snapshot showing column density from a simulation of a star passing through a protoplanetary disk. Strong spiral features, ejected disk material, and material captured by the intruding star are visible.